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DOI:

[10.1016/j.rasd.2017.07.005](https://doi.org/10.1016/j.rasd.2017.07.005)

Document Version

Peer reviewed version

[Link to publication record in King's Research Portal](#)

Citation for published version (APA):

Spain, D., Blainey, S. H., & Vaillancourt, K. (2017). Group cognitive behaviour therapy (CBT) for social interaction anxiety in adults with autism spectrum disorders (ASD). *Research In Autism Spectrum Disorders*, 41–42, 20–30. <https://doi.org/10.1016/j.rasd.2017.07.005>

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**Group cognitive behaviour therapy (CBT) for social interaction anxiety
in adults with autism spectrum disorders (ASD)**

Author note

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Acknowledgments

We are grateful to the individuals who participated. Acknowledgements to the clinical team at the Adult Autism (Behavioural Genetics) Services, South London & Maudsley NHS Foundation Trust, in particular, Ermione Neophytou and Alexandra Hiles, both of whom helped immensely with the set up and running of some of these groups. DS is funded by a National Institute for Health Research (NIHR) Clinical Doctoral Research Fellowship (CDRF – 2012 – 03 – 059). This presents independent research funded by the NIHR. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health.

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Abstract

Background Group social skills interventions (SSI) are partially effective for addressing the communication and social interaction impairments experienced by individuals with autism spectrum disorders (ASD). Social anxiety has been found to be a moderating mechanism for SSI in young people with ASD. Comparatively few studies have investigated the effectiveness of SSI in the adult ASD population, and none so far have investigated group approaches incorporating SSI and anxiety management techniques.

Method The present study describes the design and evaluation of a non-randomised single-arm, 11 week group interaction anxiety and social skills intervention, piloted on three occasions during routine clinical practice at an adult ASD service. The intervention was informed by a cognitive behaviour therapy (CBT) framework. Eighteen cognitively-able adult males with ASD attended. Outcome measures were completed pre- and post-intervention.

Results Self-reported social anxiety improved ($p = .01$, $d = 0.65$). Low mood, general anxiety and functioning did not change significantly ($p > .05$, $d < 0.20$). Qualitative feedback indicated that participants found the intervention to be acceptable and useful for improving social knowledge and coping strategies, and reducing avoidance behaviours. Attrition was low ($n = 2$).

Conclusions These results suggest that integrating SSI and anxiety management techniques in a group format is acceptable to adults with ASD, and can reduce symptoms of social anxiety. Whether SSI enhance social skills in adults requires further investigation. In clinical practice, consideration should be given to augmenting SSI with CBT techniques designed to target concurrent symptoms of social anxiety.

Keywords

Autism spectrum disorders (ASD); Asperger syndrome; Adults; Social anxiety; Social skills; Group cognitive behaviour therapy (CBT)

Introduction

Individuals with autism spectrum disorders (ASD) present with qualitative and quantitative impairments in communication, experience difficulties initiating and sustaining reciprocal social interaction, and tend to engage in a narrow repertoire of interests and routinised behaviours (APA, 2013; WHO, 1992). Deficits in neuropsychological functioning commonly co-occur, such as in theory of mind (Baron-Cohen et al., 2001), executive functioning (Hill, 2004) and central coherence (Brunsdon & Happé, 2014). Rates of psychiatric comorbidity, notably anxiety and affective disorders, are substantially higher in young people and adults with ASD compared with the non-ASD population (e.g. Russell et al., 2016; van Steensel & Heeman, in press). Together, this reflects the multiple factors that may influence the psychosocial functioning of individuals with ASD.

The majority of research describing the psychological and social outcomes of individuals with ASD has focused on young people; yet a handful of quantitative cross-sectional and longitudinal studies have included adolescents and adults. Impairments in communication and social interaction, for example, have been found to negatively impact education, occupation, and adaptive functioning (Howlin, Goode, Hutton & Rutter, 2004; Levy & Perry, 2011; Magiati, Tay & Howlin, 2014; Orsmond, Krauss & Seltzer, 2004). Moreover, social impairments are associated with adverse psychosocial outcomes, including negative affect (anxiety and low mood), limited social networks and loneliness (Chang, Quan & Wood, 2012; Howlin, Moss, Savage & Rutter, 2013; McVey et al., 2016). Qualitative studies have also demonstrated that adults with ASD perceive there to be links between their ASD and their interactions with others; for instance, peer relationships can be positive but often are negative, and difficulties at work are partly due to problems knowing how to manage in social situations (DePape & Lindsay, 2016; Sperry & Mesibov, 2005).

Clinical guidelines state that adults with ASD should be able to access psychosocial interventions, including those that address social skills competence i.e. social skills interventions (SSI) (NICE, 2013a). While SSI for young people with ASD have been delivered via multiple modalities – including individual, group-based and virtual reality approaches – the utility and acceptability of SSI for adults, particularly those aged 30 or older, has been underexplored. Preliminary evidence, however, indicates that adults can benefit from group SSI (GSSI), which incorporate psychoeducational, skills-based and/or behavioural strategies (see systematic reviews by Reichow, Steiner & Volkmar, 2012; Spain & Blainey, 2015). Delivery of SSI via groups, as opposed to one-to-

one sessions, may be advantageous as these provide implicit and explicit opportunities for normalising experiences, practising of skills with others and role-modelling. Additionally, many adults with ASD have had fewer social relationships or less positive contact with peers than they would have liked, or would be typical for their age group. Thus, groups can offer the opportunity to mix with, and observe peers, and test out subtle and overt social skills.

To date, there have been three main types of GSSI piloted with adults with ASD: those designed to enhance the skills required to form and maintain friendships (the Program for the Education and Enrichment of Relational Skills (PEERS) program; Gantman, Kaap, Orenski & Laugeson, 2012; McVey et al., 2016); or better problem-solving, and social and vocational skills (the Aspirations program; Hillier, Fish, Cloppert & Beversdorf, 2007; Hillier, Fish, Seagel & Bevesdorf, 2011); or improve general interaction skills, stress, and emotion recognition and regulation (Howlin & Yates, 1999). Overall, study results indicate improvements in participants' social knowledge and understanding, and anxiety and low mood. While there are signs that social functioning improves post-intervention, study authors also note that participants experience difficulty with generalising skills to wider contexts; a finding also reported for GSSI for young people with ASD (Gates, Kang & Lerner, 2017).

Consequently, there has been some consideration of the mechanisms which may mediate the success or otherwise of SSI. Co-morbid anxiety may be a relevant factor (see also Hillier, Fish, Siegel & Beversdorf, 2011; Maddox, Miyazaki & White, 2016; Pellecchia, Connell, Kerns, Xie, Marcus & Mandell, 2016; White, Oswald, Ollendick & Scahill, 2009), and social anxiety, in particular, has been reported to be a predictor of response to SSI (Maddox, Miyazaki & White, 2016, Pellecchia, Connell, Kerns, Xie, Marcus & Mandell, 2016). Data from these studies tentatively indicate that social anxiety may be associated with poorer social skills in individuals with ASD (see Bellini, 2006); causal influences in both directions appear plausible. Social and communication impairments may contribute to repeated experiences of unsuccessful or negative reactions, especially with peers (Cappadocia, Weiss & Pepler, 2012). These may in turn contribute to the development of negative thoughts and beliefs (e.g., pertaining to inferiority or inadequacy), and hence, social anxiety. In the other direction, social anxiety may lead to a lack of friendships and restrict the range of social situations that individuals with ASD encounter, resulting in fewer observations of 'appropriate' social interaction and

fewer opportunities to test out social skills. Indeed, anxiety may in fact make individuals reticent to engage in social situations or practice those social skills learnt in SSI.

In summary, empirical data indicate that lack of social knowledge and competence, and anxiety about social interaction may well be inter-related. Yet, to date, no studies have investigated the feasibility and effectiveness of interventions to target both social skills and social anxiety concurrently in adults with ASD. Previous studies have recruited relatively young adults, and it is not clear that samples are representative of the wider adult population, including those individuals accessing clinical services across the lifespan. Also, none of these studies have been informed explicitly by cognitive behaviour therapy (CBT); an intervention modality found to be effective for targeting anxiety (Storch et al., 2015; Wood et al., 2015) and social knowledge and anxiety in young people with ASD (White et al., 2013), and beliefs and behaviours associated with social anxiety in children and adults with ASD (Spain, Sin, Harwood, Mendez & Happé, 2017). In response to clinical need and building on the literature, we designed and piloted a group-based intervention for adults with ASD, which focused on providing psychoeducation, reducing anxiety about social interaction, enhancing social knowledge and problem-solving around social skills impairments. Here, we describe the development and evaluation of the intervention, along with identifying implications for clinical practice and research.

Methods

Design

We used a non-randomised single-arm study design and piloted the group intervention on three separate occasions between 2013 and 2016.

Participants

We recruited cognitively-able adult males from a UK national adult ASD psychological therapies service (AAPTS). The AAPTS provides tertiary level outpatient psychological interventions to adults aged 18 and over, residing in England. All adults seen at the service have a clinical diagnosis of ASD. We solely recruited males for three principal reasons. First, fewer women are referred to the AAPTS per annum (approximately 20% of referrals), perhaps reflecting sex differences or biases in ASD diagnostic rates (e.g. Wilson et al., 2016). Second, women with ASD are hypothesised to manage their symptoms and social difficulties in distinctly different ways to men, e.g. through 'camouflaging' (Lai et al., 2016). Thus, they may benefit from sex-specific interventions

(Blainey & Spain, 2014; Jamison & Oeth Schuttler, 2017). Finally, mixed groups can result in complex dynamics, which we considered could serve to detract from the purpose of the group.

Of 22 adult males approached, 18 agreed to participate (an 82% response rate). Five attended each of the first two groups, and eight attended the third group. Potential participants were not obliged to say why they declined to attend, but we noted that this was largely due to difficulties travelling to the hospital, conflicts with other commitments, or a preference not to engage in a group. Participants were aged between 22 and 48 (mean 31, sd 7.9). Fifteen participants were White British, two were Black British and one was British Asian. All had a confirmed diagnosis of ASD ($n = 12$ Asperger syndrome; $n = 4$ childhood autism; $n = 2$ atypical autism) and none had a co-morbid diagnosis of Intellectual Disability (ID). In the present sample, 14 participants (78%) were first diagnosed with ASD in adulthood following a multidisciplinary team clinical assessment. Diagnoses had been confirmed in most cases using either the Autism Diagnostic Interview-revised (ADI-r; Lord, Rutter & Le Couteur, 1994) ($n=10$), and/or Autism Diagnostic Observation Schedule (ADOS-g; Lord et al., 2000) ($n=5$), which were conducted by research reliable clinicians or researchers (See Table 1 for diagnostic information). In terms of education, two had dropped out of secondary school (reasons for this were not reported), fifteen had completed secondary school, and seven had completed graduate education. At the time of the group, three participants were employed (one full-time, two part-time), and one was in continuing education. Nine participants were taking regular medication: anti-depressants ($n = 6$), stimulant medication for attention deficit hyperactivity disorder (ADHD) ($n = 1$), anti-epileptics ($n = 1$) and an atypical anti-psychotic ($n = 1$).

(Table 1 about here)

In terms of the general clinical presentation of participants, we did not formally assess psychiatric co-morbidity. However, clinicians referring into the group screened for suitability and individuals with moderate to severe or complex presentations were not invited as it was considered that these symptoms required intervention prior to participating in this group. The average participant score on the Toronto alexithymia scale (TAS-20) (Bagby, Parker & Taylor, 1994) was 58 (sd 10.9, range 39-73). Within this, 75% of participants ($n=14$) scored above cut-off, suggesting a high level of alexithymia in the overall sample. Self-reported self-esteem scores on the Rosenberg self-esteem scale (Rosenberg, 1965) were in the low range (mean score 21, sd 10.3, range 5-38). A non-validated satisfaction with friendships questionnaire showed that the majority of participants (62%) had a best

friend, although 38% did not. Half were 'very satisfied' or 'quite satisfied' with their current friendships, while half were 'quite dissatisfied' or 'very dissatisfied'. The majority of participants (88%) wanted more friends, and reported that they would like to be close to people, with most stating a preference for having at least one conversation with a friend every day (88%). Linked to this, 75% reported difficulty maintaining friendships, suggesting that their desires for social contact were not currently being met.

We invited patients to attend, following a course of individual CBT, and where anxiety around understanding and managing social cues and situations seemed to be a presenting problem. While social skills enhancement and social anxiety symptoms were addressed during individual CBT sessions for some patients, this was not necessarily the primary remit, e.g. because other clinically significant symptoms were targeted in the first instance. We excluded patients who presented with symptoms that substantially interfered with their capacity, at that time, to engage in prolonged interaction (e.g. psychosis), or in cases where significant risk to self or others took clinical precedence and ongoing assessment and management of this was beyond the scope of the group. Decision-making about group eligibility was assessed by the treating clinician (qualified clinical psychologists or CBT therapists), working with them individually.

Intervention

It was considered that a group format would both provide a more naturalistic environment in which to practice social skills and address social anxiety symptoms, and also build upon work undertaken during one-to-one sessions. We reviewed published descriptions of social skills and CBT interventions for adults with ASD (Gantman, Kaap, Orenski & Laugeson, 2012; Hesselmark, Plenty & Bejerot, 2014; Hillier, Fish, Cloppert & Beversdorf, 2007; Howlin & Yates, 1999; Spain, Sin, Chalder, Murphy & Happé, 2015). Elements of these were incorporated into an intervention manual, developed by group facilitators. The intervention comprised 11 two-hour sessions which were run weekly, on the following topics: 1) an overview of social skills, and CBT concepts; 2) communication strengths and difficulties; 3) types of relationships; 4) goal setting; 5 and 6) conversation skills; 7) non-verbal communication; 8 and 9) emotional awareness of self and others; 10) social vulnerability; and 11) assertiveness.

Initial sessions focused on general topics so as to normalise experiences, identify commonalities between participants and set goals. In our clinical experience, goal-setting can prove

challenging for individuals with ASD, perhaps either due to inherent difficulties with abstract thought and generativity, a tendency for perseveration, or anxiety about change. As a result, we deliberately planned setting personal goals several sessions in. This involved problem-solving over-arching difficulties (e.g. with managing change) and more specific problems (e.g. the impact of anxiety or previous experiences of failure). Later sessions focused on particular aspects of social skills with a view to enhancing social understanding, reducing anxiety and increasing coping strategies.

The intervention was informed by a CBT framework, and based on the premise that there are interdependent relationships between thoughts, emotions and physical feelings, behavioural responses and coping strategies. Of note, CBT principles have underpinned some studies of GSSI for young people with ASD (see Cappadocia & Weiss, 2011; White et al., 2013). In each session, we discussed possible ways in which situations, or thoughts or emotions about social skills competence may influence particular responses, and in turn, how these responses, e.g. avoidance, may perpetuate negative thoughts and affect (see Fig. 1). Additionally, we formulated, collectively, how more neutral thoughts about social situations and alternative ways of thinking and responding, can have a positive impact on affect, and in fact, serve to reduce anxiety. We incorporated both behavioural and cognitive interventions yet, overall, more emphasis was placed on those interventions derived from cognitive principles e.g. identifying and challenging negative automatic thoughts. Behavioural strategies including exposure, were used less often during sessions, but did inform homework tasks.

(Fig. 1 about here)

The programme structure remained the same on each occasion the groups were run. While the content was broadly similar between groups, this was an iterative intervention designed to respond to participants' needs and requests as clinically indicated. For example, some group members were more interested in focusing on social skills relevant to the workplace, whereas participants in another group opted to spend more time on talking about developing relationships, as they felt reasonably confident about approaching new people. These requests were incorporated into the overall structure by utilising specific examples from these domains, e.g. focusing on assertiveness within the workplace, or on sustaining conversations, during relevant sessions.

Outcome measures

Participants were asked to complete several self-report measures. We were mindful that use of self-report questionnaires with individuals with ASD has been subject to debate (Lecavalier et al., 2013), and that the psychometric properties of psychopathology measures in this population have not been adequately researched (Brugha et al., 2015). Hence, we chose measures which had been commonly administered in adult non-clinical and clinical populations, including ASD samples. Also, participants had completed these measures regularly as part of their individual psychological treatment, meaning that the questionnaire structure and content were more familiar to them. Of note, we solely relied on self-report measures, because it was not practical to obtain informant-reports, e.g. as not all participants had regular contact with someone who knew them well. Additionally, we took the view that participants' perceptions of their difficulties, i.e. their subjective viewpoints, were more important than others' opinions, in line with central CBT principles.

The Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) was used as the primary outcome measure to assess anxiety about and avoidance of a range of social situations. The LSAS is a 24-item questionnaire which lists general social situations, such as 'participating in small groups', 'talking with people you don't know very well', and 'entering a room when others are already seated'. Items are scored on a four-point Likert scale, with scores ranging from 0 (the situation evokes no anxiety, and would never be avoided) through to 3 (indicating a severe level of anxiety, and a tendency for avoiding the situation). The maximum total score is 144. In non-ASD adult populations, a score of 60 or more implies clinically significant social anxiety symptoms. Whether these normative thresholds apply to the ASD population requires further scrutiny but, to date, the LSAS has been the most commonly used self-report social anxiety measure in adult ASD samples (e.g. Bejerot, Eriksson & Mortberg, 2014; Maddox & White, 2015; Spain et al., 2016).

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1993) was used to measure general mood and anxiety symptoms, and to assess general anxiety and depression alongside the primary outcome of interest (social anxiety). The HADS has 14 items, seven of which relate to low mood, such as 'I can laugh and see the funny side of things', and seven of which relate to general anxiety, such as 'I feel tense or wound up', and 'I get sudden feelings of panic'. Items are scored on a Likert scale, with scores ranging from 0 to 3, and a maximum total score of 21 in either subscale. The HADS has good psychometric properties (Bjelland, Dahl, Haug & Neckelmann, 2002),

and has previously been used in studies recruiting adults with ASD (e.g. Kanai et al., 2011; Spain et al., 2016).

The Work and Social Adjustment Scale (WSAS; Mundt, Marks, Shear & Greist, 2002) was used to briefly assess general functioning across domains of life such as work, home and leisure, and to assess any changes post-intervention. Of note, the WSAS is considered to measure social functioning, and is commonly used alongside mental health measures (in non-ASD samples) to quantify the impact of difficulties on the person's life (Zahra et al, 2014). The WSAS has five items, each of which is measured on a Likert scale, whereby 0 indicates no impairment and 8 indicates severe impairment. The WSAS has been used extensively with non-ASD clinical populations, and is considered sufficiently sensitive to measure differences in symptom severity and treatment-related change (Mundt, Marks, Shear & Greist, 2002). The WSAS has been used occasionally with ASD samples (Russell et al., 2013; Spain & Blainey, 2017).

We developed a short non-validated questionnaire to assess aspects of satisfaction with friendships. We opted to use this as published questionnaires about friendships, e.g. the Friendship Questionnaire (Baron-Cohen & Wheelwright, 2003) tend to be fairly lengthy. Additionally, this non-validated measure includes questions that we generally ask patients during individual CBT sessions, as this can inform areas for intervention and goals for treatment. The questionnaire had six items, relating to number of friendships, amount of contact and satisfaction with friendship circles, difficulties with forming and maintaining friendships, and preferences for being close to or distant from others. Responses were either dichotomous (e.g. I like to be close to people, or I like to be distant from people), or could be rated on a Likert scale, whereby responses ranged from 'very easy' to 'very difficult/very hard' (e.g. I find it very easy/easy/difficult/very difficult to make new friends). Data from this questionnaire were synthesised descriptively and qualitatively.

Participants also completed a non-validated feedback questionnaire, designed by the group facilitators. This was intended to assess satisfaction with, and acceptability of, the environment, session content, amount of time spent on each topic, strategies used, and the duration and number of sessions. Responses were either scored on a Likert scale (e.g. with choices ranging from 'helpful' to 'not helpful'), or could be open-ended to encourage participant feedback.

Social knowledge and skills were not directly formally assessed due to service constraints (i.e. limited time to complete social skills assessments) and participant burden, as this group was run

as part of routine service provision. Similarly, the self-report measures were selected for brevity to reduce participant burden.

Procedure

Prior to the group, we offered each patient an individual 30 minute meeting with one or all of the group facilitators to confirm presenting difficulties and risk issues, and also, to allay potential anticipatory anxiety about joining or participating in a group. Written information about when and where sessions would take place, and the group's aims and broad remit were provided in advance. Outcome measures were completed at two time points: at the beginning of the first session and at the end of the last session. The feedback questionnaire was also completed at the final session. All participants could complete these unaided, and it took approximately 20-30 minutes to do so.

Each session followed the same format: 1) introduction; 2) recap of the previous session's materials and discussion of any homework completed; 3) development of a shared understanding of topics covered; 4) identification of difficulties associated with aspects of social skills and the impact of these; 5) generation of a CBT formulation to illuminate possible links between situations, thoughts, feelings and emotions, and behaviours; 6) a break; 7) consideration of skills, strategies and solutions; and 8) homework suggestions.

Techniques included Socratic and didactic questioning styles, small and larger group discussions, role-modelling primarily by facilitators, diagrammatic illustrations, and handouts. Group facilitators disclosed some general examples of difficulties and solutions from their own lives in order to aid with normalising experiences. Summaries of the content were completed in session (written contemporaneously by one of the group facilitators), and printed out for participants to take home. Participants were not obliged to speak in the larger group, and instead they could approach facilitators at the end of each session. Homework was optional albeit strongly encouraged. Homework tasks were individualised and based on the session content; for example, participants were encouraged to try out a new skill. Homework tasks were written down and, if needed, crib sheets such as thought records were devised in session. Participants were also encouraged to use the breaks during sessions to practice social skills. Group facilitators spent the breaks with those participants who did want to use the time to practice their learning, and where appropriate links were made between the use of social skills in this unstructured time and the group content.

Therapists

Two members of staff (a trainee clinical psychologist, clinical psychologist or nurse consultant) facilitated sessions. Group facilitators met for peer supervision regularly. Both of the qualified staff had experience of developing and running therapy groups with young people and adults with and without ASD. Therapist adherence was not formally assessed.

Ethical approvals

The group intervention was conducted as part of routine service delivery. We obtained clinical governance approvals from the NHS Trust to measure outcomes and disseminate anonymised findings. As advised by the governance department, we did not need to seek formal NHS research ethics approvals.

Statistical analyses

Anonymised data were entered into Excel, and then IBM SPSS Version 24. Prior to the analyses, data were checked for normality, using the Shapiro Wilks test. All scores met criteria for a normal distribution (all $W < 0.98$, all $p > 0.27$). Data were therefore analysed using parametric tests. We calculated descriptive statistics for each variable, and then estimated differences in questionnaire scores pre- and post-intervention (one sample t tests), as well as effect sizes (Cohen's d). Two-sided p values are reported; a significance level of 0.05 was considered statistically significant. The feedback questionnaire comprised open-ended questions and qualitative feedback was analysed using content analysis to describe broad themes.

Results

Two participants dropped out after one session because they found the group environment overwhelming and felt too anxious to continue. Sixteen participants completed the groups, 14 of whom completed all measures (82%).

Outcome measures

Questionnaire scores and results are shown in Table 2. When comparing scores pre-and post-intervention, significant improvements were seen in anxiety and avoidance of social situations, as measured by the LSAS total score ($p = 0.01$, $d = 0.65$), but not subscales (all $p > 0.13$, $d < 0.43$). Differences, however, were not significant in terms of low mood and general anxiety (both measured by the HADS), or in general functioning (measured by the WSAS) (all $p > 0.15$, $d < 0.20$).

(Table 2 about here)

Qualitative feedback

Feedback regarding the group was sought at the final session, whereby participants completed a short questionnaire. Overall, feedback was positive. The majority of participants stated that they had found it helpful to meet other people in a similar situation. Some described feeling more confident in social situations, e.g. trying out new ways of conversing and incorporating a broader range of topics, as well as feeling better able to cope with and manage anxious thoughts and feelings. Participants reported on what they had gained from the group (in response to an open-ended question), which included an increased ability to identify different types and aspects of relationships and enhanced understanding of modes of non-verbal communication and assertiveness. This feedback suggests an improvement in social knowledge, although this was not objectively assessed. In terms of suggestions for how the group could be improved, some participants stated that they would have preferred to be given additional practical strategies, e.g. for specific situations, or for the group to have incorporated additional opportunities for skills rehearsal.

Discussion

Social skills impairments and social anxiety symptoms are commonly experienced by individuals with ASD and they can substantially affect social, educational and occupational functioning. We piloted a novel CBT group intervention for cognitively-able men with ASD, adopting a combined approach to target social skills knowledge and social anxiety. Results suggest that attendance at the group led to a reduction in anxiety about, and avoidance of, social situations. The group was acceptable to participants and feedback was generally positive. Dropout rates were low, with only two participants (9%) failing to complete the group.

These preliminary findings reflect those of previous studies which have demonstrated a reduction in anxiety in individuals with ASD following group SSI (e.g. Hillier, Fish, Siegel & Beversdorf, 2011; Schohl et al., 2014), including those which incorporate CBT principles and techniques (Pellachia et al., 2016; White et al., 2010). It is possible that attendance at a group and the normalisation of social difficulties led to increased confidence, and facilitated discussion about and practice of social skills in a neutral environment. In turn, this may have reduced concerns about social situations. Additionally, the group approach incorporated exposure and habituation, which are effective interventions for (social) anxiety. It may be that this combination of approaches and strategies served to reduce facets of social anxiety. The evidence for SSI for social anxiety is equivocal in typically developing samples (Mayo-Wilson et al., 2014), but it does seem likely that

social skills and social anxiety are linked concepts for individuals with ASD. For example, poorer social skills may increase the risk of social anxiety (e.g. Bellini, 2006), and bi-directionally, social anxiety may affect propensity to use or test out social skills (e.g. initiating social overtures). This may result in avoidance, leading to social isolation and a lack of opportunities to develop and maintain skills. These preliminary findings raise the possibility that a combination of social anxiety interventions and SSI approaches may have clinical utility for individuals with ASD.

This group utilised a CBT-based approach, in part to enable participants to develop their own solutions. While CBT-informed group SSI seem to fare similarly to other SSI frameworks in young people with ASD (Cappadocia & Weiss, 2011), adults may find these techniques more accessible and useful as they target both anxiety and skills deficits in tandem. CBT approaches such as those used here incorporate problem-solving skills, which may lend themselves more readily to other situations. This is because CBT focuses on enabling individualised solutions to be developed (Beck, 2011), which may be more flexible than the learning of specific skills for specific situations. This is likely to be particularly useful for adults who may be expected to problem-solve their social difficulties more independently than younger people with ASD, or may lack support with problem-solving e.g. due to diminished social networks. The findings described here contribute to the evidence base which suggests that young people and adults with ASD can derive benefit from CBT for core and co-morbid symptoms (Binnie & Blainey, 2013; Spain, Sin, Chalder, Murphy & Happé, 2015; Storch et al., 2015; Wood et al., 2015).

Unlike other GSSI offered to young adults with ASD, the present study did not include a carers group or have involvement from family members. Previous GSSI such as the PEERS (e.g. Gantman, Kaap, Orenski & Laugeson, 2012), and Aspirations programs (e.g. Hillier, Fish, Cloppert & Beversdorf, 2007) have incorporated parent or carer groups as a means of ensuring that participants are supported to practice skills at home and that they engage in regular social opportunities. While this may be a useful way to enable the generalisation of skills, such models tend to be offered to a younger population (under the age of 25), whereas our intervention targeted a broader adult population. Also, we did not offer a separate carers' group because participants were cognitively-able and they did not necessarily have regular support. This perhaps makes this group more ecologically valid, given the relative isolation that many individuals with ASD report. However, it also means that there is likely to have been limited support outside of the group for participants to test out skills. This

was also reflected in some of the group feedback, with some participants requesting additional practice opportunities, and further development of this group could include increased in-session activities, or more *in vivo* practice (e.g. setting up a non-clinic based social activity for group participants). Some other groups, such as the PEERS program (Gantman, Kaap, Orenski & Laugeson, 2012; Laugeson, Gantman, Kaap, Orenski & Ellingsen, 2015; McVey et al., 2016) have seemed to benefit from a similar approach, yet the difficulty with generalising skills to external settings is likely to remain without increased support to practice these skills.

In relation to this and other SSI studies, there are clearly inherent complexities associated with choosing self-, informant- and/or clinician-rated mental health outcome measures for use in either clinical practice or intervention research. Psychometric properties of outcome measures commonly completed by individuals who do not have ASD, have not been adequately investigated or established for ASD samples. This potentially raises issues about the extent to which they are valid (e.g. ecologically valid) and reliable (e.g. in terms of test retest reliability), and hence, are suitable for measuring changes in symptoms and functioning.

Use of self-report questionnaires may be problematic for some individuals, e.g. due to the potential impact of alexithymia. Individuals with ASD may also experience difficulties with understanding abstract concepts, or the wording of statements or questions (Mazefsky, Kao & Oswald, 2011). The majority of the present sample scored above the cut-off threshold for alexithymia, which may have affected questionnaire scores, in that participants may have found it difficult to reflect on their current mental state and ability to quantify this. To mitigate this, we opted to use brief and relatively concrete measures and those that participants had filled in previously during individual CBT. An alternative could have been to utilise an informant-rated measure. However, in an adult clinical population this can be challenging to obtain, e.g. due to social isolation or lack of regular contact with significant others, and thus, a lack of available informants. Clinician-administered scales may potentially be confounded by the social and communication impairments associated with ASD, and such measures are also significantly more resource intensive and hence more challenging to obtain in a clinical setting.

Choosing valid and reliable measures of social skills also poses challenges, and conceptually, can prove difficult to operationalise. Social skills feasibly include social knowledge, e.g. information or scripts for particular situations; communication and interaction skills, e.g. the ability to

apply behavioural skills, in context; social functioning, e.g. the ability to manage effectively in a social situation; and social anxiety, e.g. fear related to social situations and associated avoidance of these. While previous GSSI have reported increases in social knowledge post-intervention, this has not necessarily been associated with any change in other areas (e.g. Gantmann et al, 2012; Hillier et al, 2007). In the present study, participants completed a brief well-validated general measure of functioning (the WSAS), as a way to rate social functioning. The lack of change, however, seen in scores post-intervention may mean that this questionnaire is not sufficiently sensitive (or specific) to assess change in this clinical population, or that the intervention may not have been long enough to change functioning over the relatively brief time-frame.

Study limitations

We note several limitations. As such, the overall sample was small and due to the single-arm design, the analyses that we performed were limited, making it difficult to draw more robust conclusions. A selective sample of participants was recruited and there was a range of clinical presentations represented within the groups. While this is perhaps more reflective of individuals presenting to routine services, it does make it difficult to specify precisely which sub-set of the adult ASD population may benefit most from such an intervention. Also, although mental health symptoms were routinely assessed by treating clinicians, no formal interview schedule was used, and this may indicate a lack of standardisation of the assessment of participants' co-morbid symptoms. All participants were male: we cannot be sure that women with ASD (an empirically neglected population, and rarely included in SSI; Gates, Kang & Lerner, 2017) would also find this useful.

In relation to the intervention itself there are a number of limitations, including the lack of validation of the approach, no oversight of therapist adherence to the manual, and a lack of monitoring of compliance with suggested homework tasks. Each of these potentially impact on the feasibility of replicating the intervention, albeit that in clinical practice, variations in the delivery of interventions and weighting of in-session versus between-session tasks, are relatively standard.

Outcome measures were all self-report. Inclusion of a clinician-rated measure, either of social skills (knowledge, skills or functioning) or mental health symptoms, would have been a valuable addition. Further, each construct e.g. social anxiety or low mood, was assessed using one rather than multiple questionnaires. None of these have been validated for use with adults with ASD, and so it is not clear that these are sufficiently valid and reliable, and therefore, adequately measured presenting

symptoms and impairment. We did not ask participants to complete the satisfaction with friendships questionnaire post-intervention, although this would have helped to quantify whether perceptions about the extent or quality of friendships changed over time. Similarly, while we did ask participants for qualitative feedback about whether their social knowledge and understanding had improved, we did not rate this formally. Finally, despite the focus on social skills alongside social anxiety, the lack of social skills specific outcome measures – either completed by participants, clinicians or independent raters – is a significant limitation, meaning that it is difficult to judge the direct impact of the intervention on any social skills.

Generalisability

The intervention was offered as part of routine clinical care at a tertiary service, and it is important to consider the extent to which findings reported here are generalisable to other adult ASD populations and different clinical settings. The average score on the TAS-20 was around the cut-off for alexithymia, with 75% of the sample scoring above the cut-off. This supports previous findings that suggest alexithymia scores may be high in an adult ASD sample (Berthoz & Hill, 2005). It is possible that this sample may have had greater levels of alexithymia than the wider population of individuals with ASD, potentially impacting on how participants responded to self-report measures and/or their ability to utilise the intervention (Foulkes, Bird, Gokcen, McCrory & Viding, 2015). However, it is noteworthy that the intervention was run within a national specialist service. As such, the client group may comprise individuals who have more complex presentations, or who have been unable to access or utilise treatment elsewhere, for example in primary care services, where service limitations may restrict access to appropriately adapted psychological therapy (Griffith, Totsika, Nash & Hastings, 2012). As such, this may be an under-studied population, and practice-based evidence such as the present study can provide preliminary information which can be further explored in more controlled trials (Holmqvist, Philips & Barkham, 2015).

Clinical implications

We consider that there are several implications for clinical practice. In our experience, and contrary to standardised protocols for addressing common mental health disorders in the non-ASD adult population (NICE, 2013b), we would advocate that patients should be offered group-based interventions after attending for individual psychological therapy. This is partly because group contexts are understandably anxiety-provoking for individuals who have social and communication

difficulties (conceivably, compounded by social anxiety), and also because individual sessions are likely to provide patients with the requisite knowledge and skills needed in order to make best use of a group, e.g. emotional literacy or an introduction to the CBT framework. While groups can be resource-effective, we suggest that the number of patients with ASD attending each group is limited, and that several facilitators are available in order that smaller group discussions and exercises can take place easily. Anecdotally, we have found that being consistent with aspects such as the timing, setting, structure, and facilitators, reduces unnecessary anxiety, albeit that this may not always be achievable. Provision of written information and visual materials may help to overcome possible impairments in memory or attention (Hill, 2004). Session duration of groups is typically longer than that of individual sessions; this implies that regular breaks should be scheduled so that patients do not feel overwhelmed. Additionally, breaks can provide a naturalistic setting within which to practice skills, engage in exposure-based tasks, or conduct behavioural experiments. An important issue to consider is how to set and manage boundaries with regards to communication between patients and facilitators outside of sessions, and between group members. In other contexts, we have found that some patients are socially naïve and vulnerable, whereas others appear overly familiar and disinhibited. We have also found that some patients receive unwanted attention and advances from other members of the group. In either instance, we consider that facilitators should have an active role even during less structured periods of each group, such as breaks, in order to manage such dynamics if they do arise. Should such situations occur, it may be valuable to tailor the intervention content so as to equip group members with the skills to navigate such situations themselves.

Given the lack of validated psychopathology measures for adults with ASD, and indeed young people, we suggest a practical approach is needed, whereby hypothesised symptoms likely to be addressed by the group remit are measured using self-report questionnaires, and potentially, individualised scales, e.g. developed in collaboration with group facilitators. Inclusion of an alexithymia scale may provide important information about participants' ability to label and describe their affective states, in order to ascertain whether the intervention should incorporate emotional literacy sessions. The appropriateness of obtaining informant-based ratings of affect or behaviour is likely to depend on factors such as the age of participants, and their volition to have others involved in their clinical care. Thus, this should be considered on a case-by-case basis, and we do not perceive that this should constitute an exclusionary criterion for group attendance. Finally, we have tended to

measure acceptability and satisfaction using Likert scales developed by facilitators. If possible, we suggest that patients are encouraged and supported to contribute to the development of these measures.

Research implications

Based on the findings reported here, and the wider literature, several implications for research are indicated. Cross-sectional studies, using quantitative and qualitative designs, are needed in order to better understand the potential links between social skills (impairments) and (social) anxiety. Ideally, studies should recruit individuals across the lifespan, to understand differing needs and possible differences in the relationship between social anxiety and social skills in males and females. There is a clear need for intervention studies (see Smith et al., 2007), designed for adults, addressing primary impairments, e.g. social and communication difficulties, as well as secondary symptoms, e.g. anxiety. Studies of SSI or GSSI should consider incorporating outcome measures intended to evaluate different facets of social skills, e.g. knowledge, behavioural skills, functioning and anxiety, as well as an alexithymia scale given that this may be a moderating or mediating mechanism of intervention effectiveness. While RCT designs, by definition, seek to maximise internal validity, we would advocate that there is a need for pragmatism. That is, future studies should establish how best to target the core impairments and symptoms experienced by individuals with ASD who may not be eligible to take part in efficacy studies, i.e. those seen in secondary and tertiary care. Process evaluations, conducted as part of intervention studies, would help to illuminate issues such as acceptability and satisfaction with treatment. Finally, participants should be followed up in the medium-term, post-intervention, in order to ascertain whether gains made are maintained in 'real world' settings.

Conclusions

Historically, the effectiveness of interventions designed to ameliorate communication and social interaction impairments have been minimally tested in adults with ASD, despite the stark reality that these impairments affect multiple aspects of daily life, across the lifespan, and serve as risk factors for mental health conditions. In samples of young people with ASD, social anxiety has been reported to moderate and predict response to SSI, perhaps reflecting theoretical and clinical findings that social skills and social anxiety are bi-directionally linked in this population. For the first time with adults, we piloted a combined interaction anxiety and social skills CBT intervention, which was

associated with reduced social anxiety and self-reported improvements in social knowledge and coping strategies, post-intervention. Future studies, using more methodologically robust designs, are needed to develop the intervention evidence-base further.

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